

Remarks on the spatial distribution of some butterflies and diurnal moths (Lepidoptera) in the Top End of the Northern Territory, Australia

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Abstract

The geographical distribution is reviewed and/or new spatial data are given for 15 species of butterflies and diurnal moths from the Top End of the Northern Territory. Three species of day-flying moths, the Zodiac Moth (*Alcides metaurus*) (family Uraniidae), *Mimusemia centralis* (Noctuidae) and *Euchromia creusa* (Aretiidae), are recorded from the Northern Territory for the first time. Two extant locations of the Purple Beak butterfly (*Libythea geoffroyi*) from Fish River Station and Gregory National Park represent the first confirmed resident breeding populations of this species in the Northern Territory. The Monarch (*Danaus plexippus*) is recorded for the first time from the Top End and western Gulf Country where a large-scale range expansion occurred during April–May 2013; other records from the Darwin area comprise intentional introductions facilitated by ‘butterfly releases’. New records of the Plain Tiger (*Danaus chrysippus*) and Northern Argus (*Junonia erigone*) suggest these species have limited ranges in northern Australia; both are considered to be rare vagrants or immigrants from Indonesia, East Timor, or adjacent islands. The White Migrant (*Catopsilia pyranthe*) appears to be a rare seasonal migrant to the Darwin area and nearby locations from further inland. The White-banded Line-blue (*Nacaduba kurawa*) is confirmed as occurring in the Darwin area. The Sapphire Blue (*Theclinesthes sulphiteus*) and the Glistening Line-blue (*Sabulana scintillata*) are newly recorded from the western Gulf of Carpentaria and Gove Peninsula, respectively, extending their distribution considerably further east in the Top End. In contrast, the Plumbago Blue (*Leptotes plinius*) is considered to be erroneous, and accordingly this species is removed from the lepidopteran inventory for the Top End. The Orchard Swallowtail (*Papilio aegeus*), No-brand Grass-yellow (*Eurema brigitta*) and Lurcher (*Yoma sabina*) have narrower ranges within the Northern Territory than previously suspected, being restricted to north-eastern Arnhem Land and/or the Gulf of Carpentaria. Within the Top End, six species, including the Gove Crow (*Euploea alcatheae enastris*), are restricted to northeastern Arnhem Land, but three others, *A. metaurus*, *E. brigitta*, and Red-banded Jezebel (*Delias mysis*), are probably rare vagrants from northern Queensland.

Introduction

The diversity, composition and geographical distribution of butterflies in northern Australia remain poorly known relative to other parts of the continent, such as eastern and southeastern Australia, where there has been a long tradition of effort by collectors. Indeed, the sheer vastness of, and extent of natural vegetation in, the Kimberley and 'Top End', two major subregions of the Australian Monsoon Tropics, coupled with limited access during the wet season, renders northern Australia one of the last frontiers on the continent for lepidopteran research (Braby 2008; Dunn & Franklin 2010; Bisa 2013).

During the course of compiling a critical inventory of butterflies and diurnal moths for this large section of Australia for conservation purposes (M.F. Braby, D. Bisa, D.C. Franklin & S. Keates, unpubl. data), a number of spatial records have come to the author's attention that require comment and clarification. Several of these have already been the subject of intense scrutiny (see Meyer *et al.* 2006; Braby 2008, 2012a), such that five species recorded from the Top End (*Oriens angustulus*, *Pseudoborbo bevani*, *Telicota mesoptis*, *Deudorix diovis*, *Theclinessthes onycha*), three species from the Kimberley (*Delias mysis*, *Danans plexippus*, *Theclinessthes serpentatus*), plus a further two species from the Kimberley–Top End (*Pelopidas agna*, *Telicota ancilla*) have been removed from the inventory. This was because the records were deemed to be in error, either comprising misidentifications (determination errors), or mislabelling (transcription errors), or there was doubt regarding their authenticity with insufficient evidence provided to substantiate their presence. In another case, the taxon *Telicota ancilla bandina* proved to be a junior synonym of *T. angia krefftii* (Braby 2012a).

The aim of this article is to clarify the spatial distribution of a further four species of butterflies (*Papilio aegens*, *Eurema brigitta*, *Yoma sabina*, *Ixoptes plinius*) in the Top End for which there is considerable uncertainty. In addition, new spatial data are provided for 11 species of butterflies and diurnal moths in the Top End (*Alcides metaurus*, *Mimeusemia centralis*, *Euchromia creusa*, *Catopsilia pyranthe*, *Libythea geoffroyi*, *Danans chrysippus*, *D. plexippus*, *Junonia erigone*, *Nacaduba kurava*, *Theclinessthes sulphitius*, *Sabulana scintillata*), three of which represent new occurrences in the Northern Territory. During the course of conducting field work in the Top End over the past decade the author has discovered a number of new localities for species, particularly from the more remote areas. The purpose of this article, however, is not so much to document all of these 'range extensions' but to highlight and critically assess some of the more significant records. The compilation also includes two recent records which comprise new species records for the Northern Territory made by renowned naturalist I. Morris. Data concerning the arrival and rapid spread of the Tawny Coster butterfly (*Acraea terpsicore*) in the Top End and Kimberley are presented elsewhere (Braby *et al.* 2014a, b).

Nomenclature for moths follows Nielsen *et al.* (1996), while that for butterflies follows Braby (2010b). The recent systematic review of Australian butterflies (Braby 2010b; 2011b) incorporates taxonomic changes to the fauna, together with changes in gender of species epithets, published since Braby (2000).

The following acronyms refer to repositories where material has been lodged or accessed:

AM	Australian Museum, Sydney
ANIC	Australian National Insect Collection, Canberra
BMNH	The Natural History Museum, London
NMV	Museum Victoria, Melbourne
NTM	Museum and Art Gallery of the Northern Territory, Darwin
NTEIC	Northern Territory Economic Insect Collection, Darwin

Spatial records

Zodiac Moth (*Alcides metaurus*) (Figure 1)

This large and spectacular diurnal moth in the family Uraniidae has not previously been recorded from the Northern Territory. In Queensland, it is well known for its overwintering aggregations and migratory flights (Smithers & Peters 1977; Coleman & Monteith 1981). At Galiwinku, Elcho Island in the Wessel Islands, I. Morris (pers. comm.) recorded *Alcides metaurus* on several occasions between 1971 and 1976, usually during the 'build-up', and in November 1972 he photographed a specimen (Figure 1) feeding at flowers of a tree of the family Myrtaceae. More recently, L. Wilson (pers. comm.) collected a specimen at Drimmie Head, Nhulunbuy on Gove Peninsula, on 27 October 2006; the moth was collected at night (2000 h) as it flew around a bright light at the Alcan refinery.

Day-flying Moth (*Mimeusemia centralis*)

This day-flying moth in the family Noctuidae, subfamily Agaristinae, has not previously been recorded from the Northern Territory. Examination of material in the ANIC indicates that, within Australia, it was known only from Queensland, extending from Cape York Peninsula, through the Wet Tropics, to Yeppoon (E.D. Edwards, pers. comm.). At Lee Point, Casuarina Coastal Reserve (12.3316°S, 130.8944°E), the author observed two males, one of which was collected (voucher specimen: 1♂ MFBC 00028 (ANIC)), at approximately 0800 h on 18 December 2007 in coastal semi-deciduous monsoon vine thicket. The individuals did not fly (except when disturbed), but were at rest low down on foliage, or sometimes tree trunks, with the head and body oriented downwards and wings folded in the tent position over the abdomen.

Day-flying Moth (*Euchromia creusa*) (Figure 2)

This spectacular diurnal moth in the family Arctiidae has not previously been recorded from the Northern Territory. Within Australia, it occurs from the Torres Strait islands (including Murray, Warraber (Sue), Moa (Banks) and Thursday Islands), to Cape Hillsborough near Mackay in coastal central Queensland, where it may be seasonally abundant (Common 1990). I. Morris (pers. comm.) photographed a specimen (Figure 2) perched on a sandstone rock near Oenpelli in central Arnhem Land in December 1993. It was the only individual encountered.



Figures 1, 2. Two species of diurnal moths newly recorded from the Northern Territory: 1. Zodiac Moth (*Alcides metaurus*) from Elcho Island; 2. *Euchromia creusa* from central Arnhem Land. (I. Morris)

Orchard Swallowtail (*Papilio acgeus acgeus*)

In northern Australia west of Cape York Peninsula, this large papilionid butterfly has been recorded in the NT from Groote Eylandt (Common & Waterhouse 1981), Marchinbar Island in the Wessel Islands (Dunn & Dunn 1991; Fenner 1991), Gove Peninsula (Dunn & Dunn 1991; Braby 2011a), and in QLD at Doomadgee (Puccetti 1991) and Karumba (Braby 2000), QLD. The larval food plants include *Micromelum minutum* (Rutaceae) on Marchinbar Island (Fenner 1991) and *Citrus* sp. (Rutaceae) at Nhulunbuy (Braby 2011a). The species has also been recorded in the intervening region of Limmen National Park, NT, where N. Collier and the author observed a male at the Nathan River Ranger Station (15.5768°S, 135.4278°E) on 14 May 2009: the specimen was observed flying in a large open area at the station residents' quarters at 1220 h and then again at 1240 h, suggesting that it was patrolling a mate-location site. Dunn & Dunn (1991), and subsequently Braby (2000, 2004), indicated that the species occurs further west at Darwin, the location of which was based on a record by J.T. Moss who collected a male and female at the RAAF base (adjacent to Darwin airport). The specimens, labelled "Darwin, NT, 30 Jan. 1978,

J.T. Moss", are currently in the private collection of J.T. Moss (pers. comm.) who recalls that "My recollections are hazy but there would have been others as well as the voucher pair. They are slightly below average size for normal *P. aegaeus*." The record is curious because *P. aegaeus* is not known to occur in the northwestern corner of the Top End, and there is no evidence of an extant breeding population persisting in the Darwin area (see also Meyer *et al.* 2006). Presumably the species was accidentally introduced to the suburbs of Darwin in the 1970s following Tropical Cyclone Tracy, but those founders failed to establish.

White Migrant (*Catopsilia pyranthe crokera*)

There are few records of this migratory pierid butterfly from the northern coastal areas of the Top End. Braby (2000) listed the species from Darwin, but Meyer *et al.* (2006) questioned its occurrence in the Darwin area, although they did acknowledge that adults may possibly be encountered during irregular seasonal migrations. Examination of material preserved in the NTM and NTEIC revealed a total of 13 specimens from the Darwin area collected during three periods: between June and August 1975 (3♂), between December 1975 and February 1976 (6♂, 1♀) and in March–April 1979 (2♂, 1♀) (Table 1). In addition to these specimens, S. Keates and the author observed one individual at Darwin High School adjacent to the George Brown Botanic Gardens near Bullocky Point, Darwin (12.4377°S, 130.8337°E), at 1220 h on 17 March 2010. The specimen settled on the ground (lawn) for a few minutes and, whilst settled, the author was able to carefully approach within 1 m, confirm its identity, sex and phenotypic form. The specimen was a male in good condition and comprised the dark form; it was clearly distinguished from the Lemon Migrant (*Catopsilia pomona*) by the pale brown striations on the underside. Subsequently, the author also recorded the species at Dundee Beach (12.7277°S, 130.3564°E) on 19 April 2012. At this location, large numbers of adults (> 30) were recorded flying along edges of rainforest or in more open areas close to the beach during the afternoon (voucher specimens: 1♂ MFBC 00781 (ANIC), 1♀ MFBC 00120 (ANIC), 1♀ NTM 1.006278).

No-brand Grass-yellow (*Eurema brigitta australis*)

In Australia, *Eurema brigitta* occurs commonly along the eastern seaboard, but Waterhouse & Lyell (1914), Common & Waterhouse (1981), Dunn & Dunn (1991) and Braby (2000, 2004) all indicated that it also occurs in the Top End, its occurrence being based on published records for Darwin (Waterhouse & Lyell 1914), Pine Creek (Angel 1951) and Daly River (Hutchinson 1978). Meyer *et al.* (2006) did not record the species in the Darwin area and called for further data to confirm its existence in the region. Extensive field investigations during the past decade by D. Bisa, D.C. Franklin and S. Keates (pers. comm.) and the author have failed to detect this species in the Northern Territory, calling into question the validity of previous records.

Table 1. Records of the White Migrant (*Catopilia pyranthe*) in the Darwin area, NT.

Location	Date	Observer Name	Specimen	Repository and voucher number
Millner, Darwin	7 June 1975	A.J. Dartnall	1♂	NTM I.002642
Smith St, Darwin	28 June 1975	A.J. Dartnall	1♂	NTM I.002640
Vestey's Beach, Darwin	August 1975	J. Elder	1♂	NTM I.002644
NT Museum, Darwin	3 Dec. 1975	J. Elder	2♂	NTM I.005296, NTM I.005297
Espanade, Darwin	4 Dec. 1975	J. Elder	2♂	NTM I.002637, NTM I.002638
Howard Springs	9 Dec. 1975	A.J. Dartnall	1♂	NTM I.002641
Smith St, Darwin	9 Dec. 1975	A. Hantos	1♂	NTM I.002639
Fannie Bay, Darwin	29 Feb. 1976	A.J. Dartnall	1♀	NTM I.002643
Quarantine Nursery, Berrimah Farm*	28 March 1979	L. Hall / M. Neal	1♂/1♀	NTEIC 174 / NTM I.002748
Forestry Section, Berrimah Farm	19 April 1979	S. Collins	1♂	NTEIC 180
Bullocky Point, Darwin	17 March 2010	M.F. Braby & S. Keates	1♂	observation

* An additional label reads "Ex. *Cassia occidentalis*"

Waterhouse & Lyell's (1914) published record for 'Port Darwin' was based on F.P. Dodd material, but personal examination of these historic specimens from the Northern Territory in the AM revealed that several catalogued under the name *Eurema brigitta* had been misidentified: a male labelled "P. Darwin, 16.2.09, F.P. Dodd", "KL15635", "G.A. Waterhouse Collection" proved to be the wet-season form of *E. laeta*; and a female labelled "Groote Eylandt, N. Territory, N.B. Tindale | Nov. 1921", "KL15636", "G.A. Waterhouse Collection" is also *E. laeta*. A second female labelled "P. Darwin, 16:2:09, F.P. Dodd", "G.A. Waterhouse Collection", "KL15635" is *E. brigitta*, but the specimen is unusually marked and it may have been mislabelled following Dodd's return to Kuranda after his 10 month visit to Darwin in 1908–1909. The only reliable record of this species in the Northern Territory is a worn female in the ANIC labelled "11.01S 136.45E, Rimbija Is., Wessel Islands, NT, 18 Jan. 1977, E.D. Edwards" (see also Dunn & Dunn 1991).

Purple Beak (*Libythea geoffroyi genia*) (Figure 9)

Although this nymphalid butterfly may be locally abundant in the Kimberley (e.g. Williams *et al.* 2006; Meyer *et al.* 2013), in the Northern Territory it is rare and very poorly known. Available temporal data in the Kimberley (records held in the Department of Land Resource Management's Flora and Fauna invertebrate atlas) suggest the species is seasonal, with adults recorded from January to July but mainly during the late wet and early dry seasons (March–May). When Waterhouse (1938, p. 219) described the taxon *genia* he recorded it from 'Darwin', noting that "Mr. G. Lyell has a small specimen from Darwin, which is no doubt this race." Waterhouse & Lyell (1914) previously listed the species from Darwin (under the name *nicevillei*) and this record was probably based on Lyell's specimen. Subsequently, Common and Waterhouse (1981) recorded the subspecies from Rimbija Island, and this location was based on two males in the ANIC, one labelled "11.01S 136.45E, Rimbija Is., Wessel Islands, NT, 18 Jan. 1977, E.D. Edwards" and the second labelled similarly but with date "21 Jan. 1977". The only other occurrence of the species in the Northern Territory is that of Meyer *et al.* (2006) who recorded it at Palmerston near Darwin, the record being based on a single male captured by G. Martin (pers. comm.) in the early 1990s. Hence, the subspecies *genia* was hitherto known in the Northern Territory from a total of four males from only two locations. It is of interest then that the author has discovered extant populations of *L. geoffroyi* (Figure 9) at two new locations. The first of these was at Fish River Station 15 km SE of the homestead (14.2812°S, 130.9864°E) during which five adults were collected (voucher specimens: 1♂ NTM I.006387, 1♂ NTM I.006389, 1♂ MFBC 00792 (ANIC), 1♀ NTM I.006388) on 1–2 May 2012. On both days small numbers of adults were active for brief periods, between 1130–1400 h, flying rapidly around, or perching on outer twigs of, mature trees of *Celtis philippensis* approximately 3–5 m above ground level. A pupal exuvium (Figure 8) was also found on the underside of a leaf of a sapling (ca. 2.5 m high) of *C. philippensis*, not far from the apex of the plant,



Figures 3–9. Purple Beak (*Libythea geoffroyi*) in the Northern Territory: 3. habitat at Fish River Station showing semi-deciduous monsoon vine thicket on dolostone outcrop; 4. habitat at Limestone Gorge, Gregory National Park, showing semi-deciduous monsoon vine thicket on limestone karst; 5. mature trees of the larval food plant *Celtis philippensis* at Fish River Station; 6. foliage of *C. philippensis*; 7. fruits of *C. philippensis*; 8. pupal exuvium on underside of leaf of larval food plant, Fish River Station; 9. adult male on the larval food plant, Gregory National Park. (M.F. Braby)

the foliage of which had been extensively eaten. The larval food plant grew in abundance in semi-deciduous monsoon vine thicket on an isolated dolostone hill (Figures 3, 5–7) that was surrounded by savannah woodland; the site showed no evidence of fire and many of the *C. philippensis* trees were large and presumably very old. The second location was at Limestone Gorge, Gregory (Judbarra) National Park (16.0477°S, 130.3940°E). Two males in fresh condition were collected by L.J. Aitchison and the author (voucher specimens: 1♂ MFBC 00806 (ANIC), 1♂ MFBC 00807 (ANIC)) at this site, at 1115 h and 1400 h, on 31 March 2013. They were drinking from damp mud along the main walking track within the gorge flanked by steep limestone cliffs and karst formations supporting extensive patches of semi-deciduous monsoon vine thicket dominated by *C. philippensis* (Figure 4).

Plain Tiger (*Danaus chrysippus cratippus*)

This species is very poorly known from Australia. Its taxonomic distinction from *D. petilia* is currently under review (M.F. Braby, G.E. Farias Quipildos, R.I. Vane-Wright and D.J. Lohman, unpubl. data). In the Top End, *Danaus chrysippus cratippus* was previously recorded from Black Point, Cobourg Peninsula (Common & Waterhouse 1981), based on a single male specimen in the ANIC collected on 30 January 1977 by E.D. Edwards. It has also been recorded further east from Thursday Island in the Torres Strait Islands, QLD, based on a single specimen collected on 25 April 1995 (Lambkin 2009). These are the only previous records of *D. chrysippus* from Australia. During field work on Cobourg Peninsula in February–March 2007, a relatively large number of adult Plain Tigers were recorded, with 13 specimens (8♂, 5♀) collected from several sites by D.A. Lane and the author. The adults occurred together with the Lesser Wanderer (*D. petilia*) and the Swamp Tiger (*D. affinis*), but their flight was somewhat faster and more powerful than that of those species. They were much scarcer, with *D. petilia* being approximately three times more abundant than *D. chrysippus*. Most specimens of *D. chrysippus* were recorded in paperbark swampland along the edge of freshwater lagoons. In this habitat, males were noted to establish mate-location sites by perching low down on reeds and dead branches for short periods before dispersing to other sites. A freshly emerged female was collected at 1300 h on 21 February, drying its wings, low down in foliage. An empty pupal exuvium of a *Danaus* sp. was located nearby on the vine *Cynanchum carnosum* (Apocynaceae), which grew abundantly in the habitat, and it may have been the pupa from which the female had emerged. Another female was observed flying close to the ground searching the *C. carnosum* vines at 1155 h on 15 March, but she did not oviposit. The sites at Cobourg Peninsula were revisited by K. Nishida and the author in April 2008, but despite extensive searches there was no evidence of *D. chrysippus* and all the orange-coloured specimens of *Danaus* captured were *D. petilia*.

Monarch (*Danaus plexippus*)

There are few records of *Danaus plexippus* from northwestern and northern central Australia. The species is not known to breed in the Top End, and a record from the Kimberley (Dunn 1980) is possibly unreliable (Braby 2012a). Several recent records from Darwin, Darwin's outskirts and elsewhere in the Top End are therefore of interest and merit comment. The first of these comprises a freshly emerged female that the author collected near the Amphitheatre of the Museum and Art Gallery of the Northern Territory, at Bullocky Point, Darwin, on 2 September 2009 (deposited in NTM). That specimen had almost certainly originated from a release of butterflies as part of a wedding which was held the previous day in the Museum grounds by 'All About Party Hire', who purchased live Monarchs from the company Butterfly Releases Pty Ltd based in Brisbane. The next record was at Holmes Jungle Conservation Park near Darwin where the author observed an adult in fresh condition between 1645 and 1647 h flying in an open recently-slashed grassy area adjacent to Vanderlin Drive on 5 March 2013. The specimen flew with a powerful flight 1–2 m above the ground and it came within a few metres of the author so that it was readily identified by its large size and distinctive dark orange-brown colour pattern. Subsequently, the species was observed in Kakadu National Park sometime during April 2013 by T. Christopherson, and then during May 2013 the author recorded it near Borroloola and near Elliott, NT, as well as at several sites in the Gulf Country of northwestern Queensland not far from the Northern Territory border (Table 2). Most of these sightings comprised single individuals, but at Karumba, QLD, many adults were seen. Perhaps significantly, a single individual was also observed in central Australia in May 2013. J. Archibald informed me that on 19 May 2013 he and S. Richards observed an adult flying westwards at the Palmer River Crossing on the track to Illamurta Springs, Henbury Station, NT (24.5405°S, 132.6658°E). The observation was made at 1230 h on a fine warm breezy day.

The most recent record of *D. plexippus* was on 30 November 2013 when an adult in perfect condition (recently emerged) was collected from a coastal monsoon vine thicket in the Gunn Point area (12.2276°S, 131.0312°E) (c. 30 km NE of Darwin) by D. Bisa and the author (voucher specimen: 1♂ I.008997 (NTM)).

Northern Argus (*Junonia erigone*)

In Australia, this species of butterfly was previously known only from a single female in the ANIC collected from Rimbija Island, Wessel Islands, NT, on 18 January 1977 by E.D. Edwards (Edwards 1977). At Black Point, Cobourg Peninsula (11.1551°S, 132.1439°E), the author sighted a male on 8 February 2007. The individual was observed at close range (within a few metres) at 1200 h for approximately 5 mins, during which time it patrolled (with a gliding flight with wings held at 180°) or perched (with wings widely expanded) on the ground in

Table 2. Records of the Monarch (*Danaus plexippus*) from the Top End and western Gulf Country of the Northern Territory and northwestern Queensland during 2013. Co-ordinates are in decimal degrees and WGS84 datum.

Location	Latitude	Longitude	Date	Observer Name	Comments
Holmes Jungle CP (Vanderlin Dve), NT	12.4027°S	130.92238°E	5 March 2013	M.F. Braby	1 adult observed at 1645 h
near South Alligator Ranger Station, Kakadu NP, NT	12.6830°S	132.4722°E	April 2013	T. Christopherson	1 adult observed
50 km SSE of town Elliott (Stuart Hwy), NT	17.9727°S	133.4321°E	7 May 2013	M.F. Braby	1 adult observed at 1030 h flying slowly in a northerly direction on eastern side of hwy
Mt Isa (Mullan St-Marian St), QLD	20.7259°S	139.5001°E	9 May 2013	M.F. Braby	1 adult observed at 1025 h EST flying slowly in a northerly direction
Karumba, QLD	17.4866°S	140.8376°E	10, 12 May 2013	M.F. Braby	> 20 adults observed in town and at Karumba Point (1♂ MFBC 00808) (ANIC)
Walker Creek, 36 km E of Karumba, QLD	17.4719°S	141.1794°E	13 May 2013	M.F. Braby	1 adult observed during late morning
Burketown, QLD	17.7410°S	139.5471°E	14 May 2013	M.F. Braby	1 adult observed at 0930 h EST feeding on flowers of <i>Melaleuca</i> tree
Gregory River crossing, Burketown-Doomadgee Rd, QLD	17.8913°S	139.2862°E	14 May 2013	M.F. Braby	1 adult collected (1♂ NTM I.008711)
Hells Gate Roadhouse, QLD	17.4554°S	138.3560°E	14 May 2013	M.F. Braby	1 adult observed at 1215 h EST
48 km N of Borroloola, NT	15.6301°S	136.3823°E	15 May 2013	M.F. Braby	1 adult observed at 1620 h flying slowly in a north-westerly direction
Gunn Point, NT	12.2276°S	131.0312°E	30 Nov. 2013	M.F. Braby & D. Bisa	1 adult collected in coastal monsoon vine thicket (1♂ NTM I.008997)

an open cleared area adjacent to coastal semi-deciduous monsoon vine thicket. The specimen evaded capture and did not return to the site over the next week as evidenced by the author's repeated and thorough searches. The individual was clearly distinguished from similar congeneric species such as the Chocolate Argus (*Junonia bedonia*) and the Meadow Argus (*J. villida*) by the presence of an olive-brown upperside ground colour in the proximal half of the wings, absence of a chocolate-brown ground colour and absence of broad bright orange rings on the upperside. It was smaller in size than *J. bedonia*, but larger than *J. villida*.

Lurcher (*Yoma sabina*)

Within the Northern Territory, the Lurcher butterfly has been recorded from Gove Peninsula (Fenner 1991) and Groote Eylandt (Common & Waterhouse 1981). Dunn & Dunn (1991) and Braby (2000, 2004) indicated that it occurs further west at Darwin, that location being based on an early record by Waterhouse & Lyell (1914). No further specimens or observations of *Yoma sabina* have been made from the Darwin area since that time (Meyer *et al.* 2006), or indeed anywhere from the northwestern corner of the Top End (M.F. Braby, D. Bisa, D.C. Franklin and S. Keates, unpubl. data), casting doubt on whether the species is established in the area. Lack of confirmation for more than 100 years from this area calls into question the reliability of Waterhouse & Lyell's (1914) historic record from Darwin.

White-banded Line-blue (*Nacaduba kurava felsina*)

Waterhouse & Lyell (1914) described this lycaenid as a subspecies based on a series of 8 individuals (3♂, 5♀) reputedly from Darwin. The butterfly appears to have a small geographical range, being restricted to the higher rainfall areas of the northwestern corner of the Top End (Meyer 1996; Braby 2000). Meyer *et al.* (2006) called for further data to confirm its existence in the Darwin area, noting that the species had not been recorded from the area since Waterhouse & Lyell (1914). The nearest known location of the species to the city of Darwin is Bamboo Creek (given as "the Marrakai Road jungle") (Meyer 1996), approximately 60 km SE of Darwin. At Bullocky Point, Darwin (12.4377°S, 130.8337°E), the author collected a series of 10 males (voucher specimens: 1♂ NTM 1.006005, 1♂ NTM 1.006006, 1♂ MFBC 00683 (ANIC), 1♂ MFBC 00684 (ANIC), 1♂ MFBC 00685 (ANIC), 1♂ MFBC 00686 (ANIC)) in a degraded patch of monsoon forest at the edge of a crest above Mindil Beach between November 2010 and January 2011. They were collected after midday, settled 3–4 m above the ground in a particular light gap in the understorey. When one male was removed, another male would often enter the light gap soon after and usually perch on the same branch as the first male. These observations suggest the males were using the microhabitat as a mate-location site to detect receptive females for mating. Tropical Cyclone Carlos subsequently destroyed the gap in mid February 2011, after which no more adults were encountered despite careful searches. There was no evidence of *Embelia curvinervia* (Myrsinaceae), the known larval food plant for

the White-banded Line-blue (Meyer 1996), growing in the area, but based on the number of adults encountered it was assumed that the species was breeding in the general vicinity.

Sapphire Blue (*Theclinesthes sulphitus*)

This common and widespread species of butterfly inhabits coastal areas of northern and eastern Australia, but there are surprisingly few published records from the Northern Territory. Meyer & Wilson (1995) first recorded it from the Top End where they discovered breeding populations in the Darwin area (i.e. Buffalo Creek, Shoal Bay, and Elizabeth River). Bisa (2013) observed it further west at several sites between Maningrida and Milingimbi in July and August 2007 and in August 2009. More recently, D. Bisa and D.C. Franklin collected a pair (voucher specimens: 1♂ NTM I.006020, 1♀ NTM I.006021) from Bing Bong 48 km N of Borroloola in the Gulf of Carpentaria on 6 January 2011. During a recent visit to this site (15.6301°S, 136.3823°E) the author collected a series of specimens (11♂, 2♀) on 16 May 2013 and found the species to be abundant in estuarine saltmarsh habitat dominated by *Tecticornia* spp. (Amaranthaceae).

Glistening Line-blue (*Sahulana scintillata*)

There are few records of this species of butterfly from the Northern Territory (Franklin *et al.* 2007). Waterhouse & Lyell (1914) listed it from Darwin in September. Dunn & Dunn (1991) referred to an historic record (2♀) from this location in the NMV (voucher specimens: 1♀ LEP-8834, 1♀ LEP-8835, both with label data "P Darwin, Sep. [19]08, P.F. Dodd"); these specimens no doubt formed the basis of Waterhouse & Lyell's (1914) record. Meyer *et al.* (2006) recorded the species from Buffalo Creek, Darwin, in June 2003, from the Hunting Reserve 10 km E of the Adelaide River bridge (Arnhem Hwy) in June 1994, and from the Mary River bridge (Arnhem Hwy) in June 1994. Franklin *et al.* (2007) recorded it from Gunn Point in June 2006. It has also been recorded at Darwin River (12.7872°S, 130.9702°E), where a female was netted (and released) on flowers of Turkey Bush (*Calytrix exstipulata*), on 3 July 2010 (D. Bisa and D.C. Franklin, pers. comm.). At Mary River Reserve on the Mary River crossing of the Arnhem Hwy (12.9084°S, 131.6455°E), the author collected a small series (4♂, 6♀) of adults which were feeding during the afternoon on the flowers of *Lophostemon lactifluus* growing in riparian woodland on 1–2 July 2013. Thus, there are six known locations of *Sahulana scintillata* in the Top End, all from the northwestern corner mainly during the mid-dry season (i.e. June–July). During field work in northeastern Arnhem Land, the author recorded this species on the Gove Peninsula at the Koolatong River crossing (Gapuwiyak-Balma Track) (13.1051°S, 135.7263°E) on 10–13 August 2007. A series of five males (voucher specimens: 1♂ NTM I.005247, 1♂ MFBC 00338 (ANIC)) in good condition was collected, and others observed, between 1540–1720 h. All were flying rapidly close to, or perched 5 m above ground level on, the foliage and

dead twigs of *Lophostemon psidioides* and *Acacia leptocarpa* growing in riparian paperbark open woodland.

Plumbago Blue (*Leptotes plinius pseudocassius*)

In a rather obscure note, Burns (1989) recorded this species of butterfly from the Top End in May 1985, stating "*Sintarucus pseudocassius* [sic] ... Four female, three male taken near the South Alligator River in the Kakadu NP. Species numerous." This record was subsequently accepted with some reservation by Dunn & Dunn (1991), and was followed by Braby (2000, 2004, 2008). Dunn & Dunn (1991, p. 419) remarked "Surprisingly, there are no other records of this species from near Darwin... It is desirable to have further confirmation of the species presence in the 'Top End' region." Burns' record is the only report of *Leptotes plinius* from the northern half of the Northern Territory, a species which otherwise is very common and widespread in Queensland and New South Wales, particularly in coastal and near-coastal areas. Despite extensive searches in Kakadu National Park and elsewhere (M.F. Braby, D. Bisa, D.C. Franklin and S. Keates, unpubl. data), additional evidence of this species' presence in the Top End has not been forthcoming. Moreover, *Plumbago zeylanica*, the natural larval food plant of *L. plinius* in Queensland, is distributed widely across the Top End where it occurs in pockets of monsoon vine thicket (Liddle *et al.* 1994), usually associated with rocky areas or outcrops (K. Brennan, pers. comm.). The reliability of Burns' records has previously been called into question, with several facts shown to be in error (Braby 1991). J.F. Burns travelled extensively around Australia during May and June 1985 and he may have accidentally mislabelled some of the material whilst on route from northern Queensland to the Northern Territory.

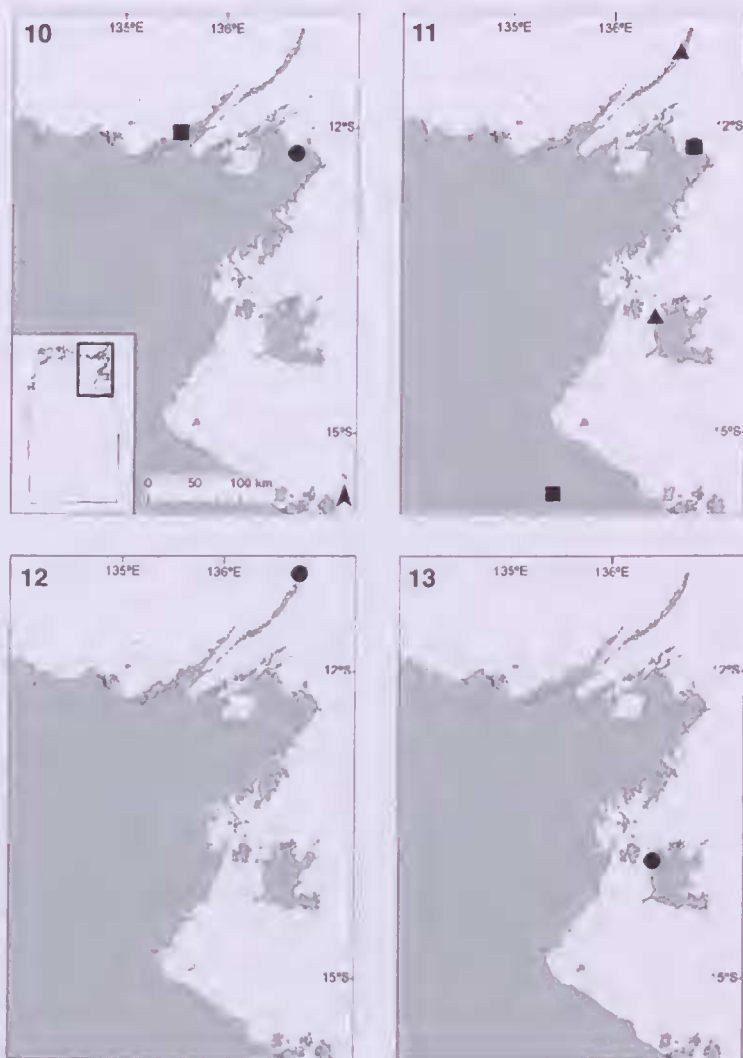
Discussion

The new spatial records documented here, and the review of previous records, serve to clarify the geographical distribution for a number of species of butterflies and diurnal moths in the Top End of the Northern Territory. Of particular interest are the records of the moths *Alcides metaurus*, *Mimusemia centralis* and *Euchromia creusa*, which represent new occurrences for the Northern Territory. In contrast, the record of the butterfly *Leptotes plinius* is considered to be erroneous and accordingly this species should be removed from the inventory of the Top End's lepidopteran fauna; the only reliable occurrence of this species in the Northern Territory is from central Australia (Pfitzner & Fargher 1976).

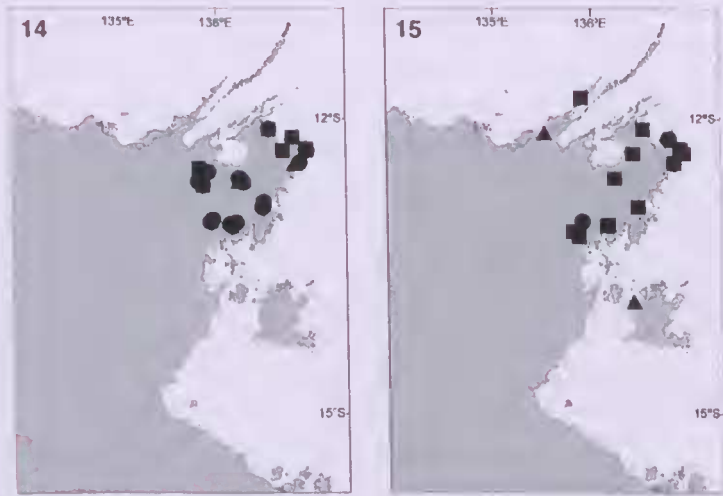
The two locations for *Libythea geoffroyi*, from Fish River Station and Gregory National Park, represent the first confirmed resident breeding populations of the species in the Northern Territory. Johnson & Valentine (1989) described the life history of the subspecies *L. geoffroyi nicevillei* from Cape York Peninsula, QLD, but the larval food plant and early stages of the subspecies *L. geoffroyi genia* from the Kimberley and Top End have not previously been reported. Members of

Libythea specialise on *Celtis* throughout the Old World (Kawahara 2009), and *C. philippensis* is the only species of the genus which occurs in northwestern Australia (i.e. its geographical range overlaps that of *L. geoffroyi genia*). Because of this specific host plant association, it has long been suspected that *C. philippensis* is the larval food plant of *L. geoffroyi genia*. Moreover, adults have frequently been collected in association with this tree (e.g. Williams *et al.* 2006; Meyer *et al.* 2013). The discovery of a pupal exuvium on a leaf of *C. philippensis* and other evidence at Fish River confirms that this tree is indeed the larval food plant of *L. geoffroyi genia*. The two locations at which the butterfly was recorded in the Top End were characterised by semi-deciduous monsoon vine thicket growing on limestone with a high density of *C. philippensis*. This habitat type is very patchy in the inland areas of the Top End; the patches are typically small in extent (comprising a few hectares) and surrounded by an extensive matrix of savannah woodland.

Danaus plexippus does not naturally occur in northwestern and northern central Australia (i.e. the species is non-resident in these regions), and at least one of the records from Darwin originated from a 'butterfly release' from stock reared interstate. Butterfly releases in Australia have largely been founded on this species (New 2008), which is native to North America but which has become naturalised in Australia. The most numerous events at which butterflies are released are weddings, but other social gatherings such as anniversaries, birthdays and even funerals can be the occasion for mass releases. The perceived advantages of substituting butterflies for confetti, balloons, or doves revolve around their aesthetic appeal and cultural/spiritual significance (e.g. they are symbolic of new life). The ecological impacts of introducing species within and outside their natural range are not well understood. New (2008) argued that the educational benefits and enhanced awareness of butterflies in the natural world generated by releases outweigh current conservation concerns, especially for species that are released within their migratory/non-permanent resident range. He recommended that releases ought to be reported/monitored and this is clearly relevant in cases where a species is released well outside its known range because it affects the way in which spatial data are collected and analysed. However, other records from remote areas elsewhere in the Top End, central Australia and the western Gulf Country—where Monarchs were particularly abundant during the early dry season of 2013—most likely represent a large-scale range expansion that occurred during April–May of that year. For three of the observations, adults were flying in a northerly or north-westerly direction, which suggests they may have originated from breeding sites further southeast along the eastern coast (Smithers 1977). Further observations are needed to determine if such a movement is an annual phenomenon or if it was a response to an unusual weather pattern (e.g. the floods that lead to proliferation of larval food resources and hence high butterfly population densities) that prevailed during the 2012–2013 wet season.



Figures 10–13. Known spatial distribution of butterfly and diurnal moth species restricted to northeastern Arnhem Land and/or the Gulf of Carpentaria within the Top End, NT: **10.** Zodiac Moth (*Alcides metaurus*); **11.** Orchard Swallowtail (*Papilio aegens*); **12.** No-brand Grass-yellow (*Eurema brigitta*); **13.** Red-banded Jezebel (*Delias mysis mysis*). Inset map for Figure 10 shows the Northern Territory. Symbols refer to the following sources of data: ● vouchered specimens in museum collections, ■ field observations, ▲ records published in the scientific literature.



Figures 14, 15. Known spatial distribution of butterfly species restricted to northeastern Arnhem Land within the Top End, NT: (14) Gove Crow (*Euploea akathoe enastr*); (15) Lurcher (*Yoma sabina*). Symbols refer to the following sources of data: ● vouchers specimens in museum collections, ■ field observations, ▲ records published in the scientific literature.

It is likely that *Danaus chrysippus* is not permanently established on the Australian mainland or Torres Strait, it being a rare immigrant from the Lesser Sunda Islands or Maluku. The presence of numerous adults on Cobourg Peninsula, including a freshly emerged female during the 2006–2007 wet season, provides circumstantial evidence that the species colonised the mainland (i.e. population bred temporarily) during the 2006–2007 wet season, but it did not establish. Similarly, the few records of *Junonia erigone* in January–February suggest this species is a rare vagrant to Australia, with adults dispersing from Indonesia or East Timor during the wet season, possibly facilitated by the monsoon trade winds, which blow in an east-southeasterly direction from the Lesser Sunda Islands.

Collectively, the records for *Catopsilia pyranthe* from the Darwin area and nearby locations suggest that this species is a rare seasonal immigrant or migrant to the northern coastal parts of the Top End, the species being more abundant in the semi-arid areas of the monsoon tropics. Available data suggests migrations are likely to occur mainly during the wet season (anytime from December to April), with occasional appearances in the mid-dry season (June to August).

Clarification of the spatial distribution of several species of butterfly, namely *Papilio aegaeus*, *Eurema brigitta* and *Yoma sabina*, in the Top End provides a new perspective on the extent of range restricted taxa in north-eastern Arnhem Land and the Gulf of Carpentaria. Assuming that the early published records of these three species from Darwin and nearby areas are erroneous, their geographical ranges should be considered to be restricted to northeastern Arnhem Land and/or the Gulf of Carpentaria (Figures 11, 12, 15). At least six species in the Northern Territory are confined or almost confined to this region (Figures 10–15), emphasising the uniqueness of the Gove Peninsula and its adjacent islands. Three of these species, *Papilio aegaeus* (Figure 11), *Euploea alcatheae enastri* (Braby 2010a) (Figure 14) and *Yoma sabina* (Figure 15), are resident with permanent breeding populations. In contrast, the three other species, the diurnal moth *Alcides metaurus* (Figure 10) the pierid *E. brigitta* (Figure 12) and the Red-banded Jezebel (*Delias mysis mysis*) (Figure 13), appear to be non-resident and are probably vagrants that occasionally disperse from Cape York Peninsula, QLD, across the Gulf of Carpentaria to northeastern Arnhem Land. The larval food plants of *A. metaurus* in northeastern Queensland include three species of *Omphalea* and two species of *Endospermum*, all tropical rainforest vines or tall trees in the Euphorbiaceae (Coleman & Monteith 1981; Monteith & Wood 1987; Harrison 2010; Moss 2010). None of these species occurs on the Gove Peninsula, and only one (*Endospermum myrmecophilum*) occurs in the Northern Territory (Short *et al.* 2011), where it is restricted to the Tiwi Islands and northwestern corner of the Top End (Liddle *et al.* 1994). Therefore, the occurrence of *A. metaurus* in northeastern Arnhem Land in October and November is most likely the result of vagrants dispersing from northern Queensland associated with large-scale movement of adults at that time of year. It remains to be established if *E. brigitta* is permanently established in the Wessel Islands or if the single individual captured by E.D. Edwards was a vagrant; the presence of only a single female specimen in worn condition favours the latter hypothesis. *Delias mysis mysis* is also known only from a single male specimen collected from Groote Eylandt in the Gulf of Carpentaria (Talbot 1928–37, 1943; Braby 2012b). The specimen either represents a vagrant from northern Queensland or it has been mislabelled, in which case the locality is in error.

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